JPRS-UES-86-001

10 January 1986

USSR Report

EARTH SCIENCES

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METEOROLOGY

AN-30 PHOTOGRAPHY AIRPLANE OUTFITTED FOR CLOUD-SEEDING MISSIONS

Kiev PRAVDA UKRAINY in Russian 15 Aug 85 p 4

[Article by T. Kuznetsova, engineer of the Design Bureau imeni Antonov; A. Pimenov, head of a laboratory of the Moscow Administration of Streets and Roads]

[Excerpt] A utility airplane, the AN-30M model , is an exhibit in the "Nature Conservation" pavilion of the USSR Exhibition of National Economic Achievements. This airplane literally changed the weather for the 12th World Youth and Student Festival.

On the eve of the festival's opening, the television weather forecast called for heavy rains in the capital during the afternoon. The whole festival parade, which lasted four hours, had good weather, however. This was not because the weather forecasters were wrong; the rain was driven away by 'weather protection' airplanes, which persistently fought a cyclone for six hours in the sky of the Moscow area.

The AN-30M was developed on the basis of the AN-30 aerial photography airplane at the Design Bureau imeni Antonov. The An-30M has the body of the AN-30 with its slightly raised cockpit, a glassed-in navigator's compartment that extends forward, excellent flight qualities, high reliability, good comfort for the crew, and most importantly modern pilotage-and-navigation equipment that permits flight routes and course changes to be made in the semiautomatic mode and allows takeoffs in the daytime and at night, in difficult weather conditions.

The development of this airplane was done at the request of the Moscow Main Administration of Streets and Roads. The AN-30M yields savings of 3 million rubles in the maintenance of the capital's streets during the fall and winter season alone.

'Ammunition' against precipitation (crystalline and other reagents) is loaded into containers placed inside the aircraft and also outside it, on external mounts with a streamlined shape. An aerologist directs the operations in the air. Instruments of the latest types enable him to evaluate weather conditions outside the airplane and to decide at what altitude the cloud cover should be seeded, as well as the methods which should be used.

While all of this was being explained to us, our AN-30M was gaining altitude and beginning to go to work in the sky. It seeded clouds with granules of frozen carbon dioxide for kilometer after kilometer. Such a flight can last as long as six hours without landing.

The work of airplanes of this type will take place regularly in various parts of our country. These airplanes can be used for inducing additional rainfall on farmlands, increasing snow cover, extinguishing forest fires, and other tasks.

The new utility airplane can be equipped with minimal expense at aviation enterprises because the basic model is easily adaptable to weather-modification and aerial-photography variants. By changing equipment that is easily dismantled, the airplane can be operated the year around and thus be converted into a multipurpose airplane.

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CSO: 1865/453

FACILITY FOR MODELING ORIGINS OF TYPHOONS

Moscow PRAVDA in Russian 8 Jul 85 p 7

[Article by A. Mel'nikov]

[Excerpt] Candidate of Geographic Sciences N. Pavlov, head of the laboratory for modeling tropical cyclones of the Far East Scientific Research Institute of the State Committee on Hydrometeorology and Monitoring of the Natural Environment, acquainted me with experiments that the laboratory is conducting.

"In order to predict typhoons," Nikolay Ivanovich explained, "it is necessary to understand how they are spawned and how they spread. It is important to learn about their mechanism, the 'trigger' that puts massive air flows in motion."

The efforts of the Far East meteorologists are aimed at analyzing the hydrodynamic properties of typhoons. In addition to conventional means of research, several years ago the region's first facility for modeling whirlwind formations appeared here.

The main part of the facility is a large cylindrical tank where ocean-atmosphere interaction is simulated by heating the water in it. Above it, a motion picture camera is mounted. It records processes taking place inside the tank. A laser attachment which creates a bright blue screen above the water helps to detect these processes and make them the object of pictures. The screen is the effect of a flattened-out laser beam, which provides a 'cross-section' of the whirlwind flows that arise.

"Modernization of the facility has broadened the possibilities of experiments appreciably," N. Pavlov related. "Mainly thanks to the capability that has been provided in the way of causing effects in the air space above the water surface where typhoons are simulated. Now we have available many more variants for detecting similarities between what we see in the laboratory and what occurs in nature."

Using the data from laboratory studies, it will be possible with the aid of aerospace photographs to determine with greater accuracy not only the parameters but also the pressure in the center of a tropical cyclone, and the zones of maximum winds.

The growing scope and sophistication of the research program require that its methodology and equipment be improved. The institute has contracted with the Belorussian Academy of Sciences' Minsk Institute of Heat and Mass Transfer to deliver a laser device for measuring the velocity of air flows to the Far East scientists late this year.

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METEOROLOGICAL ADAPTATION RESEARCH AT BIOLOGY INSTITUTE

Moscow TRUD in Russian 26 Sep 85 p 3

KRUSHEL'NITSKIY, Ye. (interviewer)

[Abstract] The article is an interview with Vladimir Nikolayevich Chernyavskiy, senior science associate of Rostov State University's Biology Scientific Research Institute, regarding research which he and his colleagues have been doing for about 20 years. Chernyavskiy's group has studied natural mechanisms of anticipation of weather changes in animals and human beings, as well as effects of weather conditions on human behavior and working fitness.

In 1971, Chernyavskiy recalls, his group discovered a natural phenomenon which it called 'meteorological sounds'--noise of free atmosphere which is caused by turbulent motion of the air. These sounds reflect properties of the atmosphere in a certain area, including the appearance of new air masses in the upper atmosphere. It is thought that living organisms unconsciously perceive these sounds, analyze them and modify their behavior accordingly.

Meteorological sounds have a frequency range of 2.5 to 15 kilohertz. Needed information on weather conditions is conveyed to an organism by so-called leading meteorological sounds with characteristic frequencies.

Chernyavskiy mentions that the behavior of sheep dogs was observed for four months. Weather forecasts made on the basis of these observations proved to be 92 percent accurate. Human beings are said to be capable of perceiving meteorological sounds up to a distance of 50 kilometers from their source. Chernyavskiy also comments on a hypothesis of human meteorological adaptation which his group has proposed on the basis of its research. According to it, the organism perceives and remembers whole meteorological sound-images which occur at certain intervals in certain localities, as well as corresponding programs for the readjustment of functional systems of the organism.

With regard to practical applications of this work, Chernyavskiy says that a better understanding of the biological forecasting mechanism may lead to the development of improved weather-forecasting methods and equipment. An acoustic weather-forecasting method which his group developed has been used in the Rostov-na-Donu area. Cloudiness and precipitation reportedly have been forecast with accuracies of 98 percent and 85 percent, respectively, using this method. Chernyavskiy's group has also developed a medical forecasting method using primary data, which is based on the meteorological-adaptation hypothesis.

When tested experimentally at a local enterprise, this method proved to be 92 percent accurate, according to Chernyavskiy. Pointing out that ecological factors must also be taken into account in the forecasting and prevention of illnesses, Chernyavskiy calls for organizing comprehensive systems of medical and ecological support for the population in major cities. He mentions that his group has developed a variant of such a system for the city of Rostov-na-Donu.

An appendix to the article records comments of Doctor of Biological Sciences Ye. A. Umryukhin, head of the laboratory on systemic mechanisms of human adaptation of the USSR Academy of Medical Sciences' Scientific Research Institute of Normal Physiology imeni Anokhin, regarding the results of Chernyavskiy's work.

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CSO: 1865/41

WORK ON MATHEMATICAL MODELING OF TROPICAL STORMS' WAKES

Moscow GUDOK in Russian 29 Sep 85 p 4

YAKOVLEV, A.

[Abstract] The article reports on research of tropical storms at the USSR Academy of Sciences' Institute of Oceanology imeni Shirshov. Doctor of Physical-Mathematical Sciences Konstantin Nikolayevich Fedorov, head of a laboratory of the institute, is said to be one of the most eminent specialists in this field. Fedorov is a member of the executive committee of the International Scientific Committee for Ocean Research.

Attention is focused on studies which Fedorov and his associates have made of effects of the formation of tropical storms on the surface waters of the ocean. It was discovered, in particular, that a tropical storm leaves a 'wake'--a strip of cooled water which remains in surface waters for as long as several weeks after a storm has passed. The structure of storms' wakes is now being studied for the purpose of quantitatively evaluating energy-conversion processes occurring during tropical storms, with a view toward forecasting their behavior.

A physical-mathematical model of the wake of a storm reportedly has been developed in Fedorov's laboratory. Predictions about the intensity and direction of a spawning storm can be made by calculating a model of its wake on a computer from source data such as point of origin, initial velocity, and certain energy factors, it is claimed. Fedorov expressed confidence that the behavior of storms would eventually be forecast with minimal error by such methods.

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OCEANOGRAPHY

AIRBORNE LASER FOR MEASURING PLANKTON IN LAKE

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 25 Aug 85 p 3

[Text] Armenian SSR--An original unit that is capable of focusing a laser beam at a prescribed depth in a body of water has been developed by associates of the republic Academy of Sciences' Sevan Hydrobiological Station, in collaboration with associates of the special design and technological bureau "Aerozol" in Yerevan.

This laser unit was used in an experiment that was conducted for remote measurement of the amount of phytoplankton in the high-mountain Lake Sevan.

(The photograph shows E. Margaryan and K. Badalyan, associates of the department of laser sounding methods of the "Aerozol" bureau, operating the equipment on board a helicopter during remote measurements of the water of Lake Sevan.)

FTD/SNAP
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CSO: 1865/453

SCIENTIFIC SHIP 'ZUBOV' COMPLETES NORTH ATLANTIC CRUISE

Leningrad LENINGRADSKAYA PRAVDA in Russian 9 Jul 85 p 1

[Article by S. Samoylis]

[Text] The "Professor Zubov", a scientific vessel of the USSR State Hydrometeorology Committee's Arctic and Antarctic Institute, has returned to Leningrad after completing work in the Norwegian Sea.

The scientists spent about two months conducting studies which are a part of the long-term program "Razrezy" (cross sections). It was drafted by the State Committee for Science and Technology and calls for systematic studies of the most energy-active areas of the world's oceans. The program covers the period up to 1990. As the program is implemented, scientists will obtain data on currents and temperatures of the water and their effects on the atmosphere. Such information is important for fishermen, pilots and weather forecasters.

FTD/SNAP
/5915
CSO: 1865/453

RESEARCH SHIP 'ZUBOV' TO LAUNCH WEATHER ROCKETS IN ATLANTIC

Leningrad LENINGRADSKAYA PRAVDA in Russian 14 Aug 85 p 4

[Article by T. Volgina]

[Text] A course to the central part of the Atlantic Ocean has been plotted on the navigational charts of the scientific research ship "Professor Zubov".

This scientific ship has set out from Leningrad on its 39th cruise, with a scientific expedition on board.

"The research program will be carried out in line with an assignment from the State Committee on Hydrometeorology and Monitoring of the Natural Environment," said N. A. Kornilov, deputy director of the Arctic and Antarctic Scientific Research Institute. Probing of the upper layers of the atmosphere with rockets over the Atlantic is the main purpose of the expedition. Series of meteorological rockets equipped with scientific apparatus will be launched over the ocean at several points. These rockets will soar to altitudes as high as 80 kilometers in the planet's atmosphere. This is practically the boundary of outer space. Important data on the structure and dynamics of the upper layers of the atmosphere and of the ionosphere will be obtained in this manner. Specialists will study physical processes occurring in near-earth space in conditions of minimal solar activity.

"All of this scientific information will be processed routinely on board the ship, which has its own computer center. Taking part in the expedition will be researchers in the field of atmospheric physics from Moscow and Leningrad."

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HYDROPHYSICAL STUDIES FROM SHIP 'VEYMER' IN NORTH ATLANTIC

Minsk SOVETSKAYA BELORUSSIYA in Russian 13 Aug 85 p 4

[Text] Studies of the most energy-active areas of the Atlantic will help to make long-range weather forecasts more accurate.

Velocities of water masses at various depths in the Gulf Stream and also near the island of Newfoundland off the coast of Canada have been measured from the "Arnold Veymer", a vessel of the Estonian Academy of Sciences. It is in precisely these areas that cyclones systematically give rise to active transfer of heat from the surface of the water to the atmosphere. These cyclones carry warm masses of air to the European continent, shaping its climate.

"Meteorologists can now predict the weather for a week, or for 10 days at the maximum, with a high degree of probability." related R. Kraav, head of the Baltic Sea department of the Estonian Academy of Sciences' Institute of Thermal Physics and Electrophysics, who is head of the expedition. "Understanding regularities involved in the variability of hydrophysical fields in the Atlantic, we will be able to provide guaranteed forecasts for the season and even for a year in advance."

The Estonian scientists used laser technology for the first time during the current expedition. They have succeeded in measuring underwater currents with high precision, using this equipment.

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PORT APPARATUS FOR REMOTE DETECTION OF SEA ROUGHNESS

Vilnius SOVETSKAYA LITVA in Russian 24 Jul 85 p 4

[Text] Long waves that roll in periodically from the open sea were a big problem for workers of the Klaypeda commercial seaport. They rocked ships violently and broke their mooring ropes.

Leningrad sci ntists helped the Klaypeda workers tame these elements. After carefully studying the configuration of the port's waters and mooring places, and the direction of the wind and of underwater currents that most often form cyclones, these scientists recommended the use of a number of original solutions. Now under construction in the port is a pier in which improved schemes for mooring vessels will be introduced.

The Klaypeda workers recently tested still another innovation--apparatus which the Leningrad scientists developed for remote detection of waves that roll in from time to time. At any time of the day, the port workers can detect roughness of the sea several days in advance and forecast its duration, direction, intensity and other parameters, with the aid of this unit. Special programs have been developed whose data will be processed by a computer. Results will be transmitted by controllers to port services and crews of vessels, who will prepare in advance to resist attacks by the waves.

The Leningrad scientists' recommendations have made it possible to reduce the time vessels must stand at roadsteads and at mooring places, and to ensure safe navigation on the waters of the port.

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CSO: 1865/453

RESEARCH SHIPS 'KELDYSH' AND 'KURCHATOV' RETURN FROM ATLANTIC

Moscow PRAVDA in Russian 22 Jul 85 p 3

[Text] Kaliningrad, July 21--After a cruise lasting many months, the research ships "Akademik Matislav Keldysh" and "Akademik Kurchatov" have returned to their home port. Together with another research ship, the "Vityaz", they took part in the large-scale expedition called "Mezopoligon".

Scientists under the leadership of Doctor of Physical-Mathematical Sciences Yu. Ivanov did research in the tropical waters of the Atlantic, where the ocean accumulates heat very actively. Here they studied oceanic eddy currents, which were discovered by Soviet oceanologists 15 years ago. The research data are now being processed.

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CSO: 1865/453

DEVICE FOR ANALYZING UNDERWATER TV PICTURES WITH IR CAPABILITY

Moscow TRUD in Russian 14 Aug 85 p 3

[A. Isayev (Gelendzhik and Moscow)

[Excerpt] An automatic device for analyzing underwater pictures has been developed at the USSR Academy of Sciences' Institute of Oceanology imeni Shirshov.

The innovation enables a researcher to screen out everything that is superfluous [from a TV image] and gives him only the information that he needs at a given moment.

The automatic device has a memory with which it can be programmed to discern, for example, ferromanganese nodules from other objects on the sea bottom.

A. Filatov, a science associate of the Institute of Oceanology and one of the developers of the device, related: "One of its big advantages is its adaptive character; it can adapt to conditions of its environment. When the structure of the sea bottom or the transparency and degree of light of the water change, the operator does not have to regulate anything; the device does all this by itself."

The device's capabilities are great. For one thing, it 'sees' in infrared rays. This is very valuable for determining the temperature at deep levels in the sea. Even at a depth of several thousand meters, it discerns a zone with a certain water temperature.

The device should prove to be indispensable in underwater navigation, for plotting courses for adaptive submersible robots operating at various levels or on the sea bottom.

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CSO: 1865/41

STUDIES OF DOLPHINS' COMMUNICATING SYSTEMS

Moscow TRUD in Russian 11 Oct 85 p 4

[I. Nekrasov]

[Excerpt] Initial results of studies of the behavior of beluga dolphins in the wild, which the marine bioacoustics laboratory of the USSR Academy of Sciences' Institute of Oceanology imeni Shirshov is conducting, have shown that these dolphins have a complex signaling system.

Associates of the marine bioacoustics laboratory studied the behavior of dolphins in the estuary of the Amur River while the dolphins were hunting salmon on their way to spawn. After installing powerful hydrophones in the water to record sounds, scientists on the shore observed dolphins surrounding a school of fish and driving it to a place convenient for catching the fish. The results proved most interesting: the dolphins carried on 'dialogues' while hunting!

It was decided to begin the investigation by interpreting sounds which the dolphins made while hunting individually, without dialogues. Under the direction of Doctor of Biological Sciences V. Belkovich, head of the laboratory, M. Shchekotov, a graduate student, studied tape recordings obtained during a study of dolphins in the White Sea. Shchekotov carefully analyzed more than 3,000 situations of dolphins hunting alone and concluded that all of these situations followed a regular pattern.

When a hunt was in progress, three or four dolphins spread out in the estuary. Each one emitted a booming sound which has been tentatively called a 'slap of the tail.' The purpose of this sound was to frighten and disorient the fish. At the same time, the animal sent out a series of echo-sounding signals which covered territory within a radius of 20-150 meters.

One of the hunting dolphins then spotted a fish. The dolphin instantly emitted one or two different signals resembling short screams. They are individual call signs that are characteristic of this dolphin alone.

In 3,000 situations, not a single dolphin ever 'called out' another's call sign. These signals mean: "So-and-so is beginning to hunt; please don't interfere!" In other words, each dolphin calls itself by name.

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CSO: 1865/41

RESEARCH SHIP 'SHULEYKIN' IN STUDIES OF ARCTIC SEAS

Moscow VODNYY TRANSPORT in Russian 7 Sept 85 p 4

[B. Moiseyev, captain's first mate on board the motor ship "Akademik Shuleykin"]

[Excerpt] (Radio report)--Participants in the new cruise of the "Akademik Shuleykin" are doing extended studies of the vast water expanse of two seas--the Kara and Laptev Seas. The expedition is headed by Candidate of Geographic Sciences A. Lebedev, and the ship is commanded by Captain V. Ovechkin. After leaving Leningrad and sailing through the North Atlantic, we reached Vaygach Island. We entered the Kara Sea through the Yugorskiy Shar Strait. In the southwest part of the sea, we did studies over a stretch of 150 miles in tough ice and frequently in thick fog.

Having completed research in the western zone of the Arctic, we are now headed east to the Laptev Sea. The materials that we will gather during the cruise are needed for solving a number of scientific problems, for forecasting weather and climate, and for supporting the work of certain branches of the economy of the Soviet polar region, particularly merchant shipping along the Northern Sea Route.

FTD/SNAP
/5915
CSO: 1865/453

SCANNING SUBMERSIBLE CRAFT TESTED FROM RESEARCH SHIP 'SIDORENKO'

Moscow SOVETSKAYA ROSSIYA in Russian 9 Aug 85 p 6

[V. Udachin]

[Excerpt] On June 9 of this year we published the first report of our special correspondent V. Udachin, from the new scientific research ship "Akademik Aleksandr Sidorenko", which had set out on an experimental-methodological cruise. The expedition has many days of tests of new systems for vessels of the USSR Ministry of Geology behind it. These tests took place in the Mediterranean Sea. Today, we publish our correspondent's final report.

The lights burned late in the sonar laboratory. Senior science associate Yuriy Gubanov, and engineers Vladimir Fomenko and Yevgeniy Dolgovshiy were on night duty. In the water was an instrument that is used to scan the seabed. This instrument had been lowered to a depth of half a kilometer, and the ship was pulling the craft at a speed of 6 knots. We were working in the area of the so-called Ionian Abyssal Plain. The sea depth here is great indeed, more than 4 kilometers, but the detector was penetrating it; with its side-looking sonar, it sees the seabed from a distance as great as 10 kilometers. The detector spotted a submarine ridge in the distance. "Pass alongside it," advised V. V. Okhrimenko, technical director of the cruise. We sailed for a long time; the tests of the detector were completed toward morning, and all of this time the submersible craft provided an accurate picture of the floor relief.

The personnel of the ship's underwater television laboratory received congratulations the next day. On the glowing screen of a television set, the seabed was distinctly visible. Its image was being transmitted by a television camera installed on a submersible craft traveling several meters above the seabed. Senior engineer Sergey Korkovidov transmitted commands to the craft through a communication channel and determined the most interesting objects for photographing while somewhere in the mysterious depths a camera shutter was clicking verifying the quality of the television image with control photographs. Tests conducted during the cruise and an examination of video tape have indicated that the test prototype of the new equipment is ready for operation in the ocean.

FTD/SNAP
/5915
CSO: 1865/453

LONG-TERM PROGRAM TO STUDY OCEAN'S ENERGY-ACTIVE ZONES DESCRIBED

Yerevan KOMMUNIST in Russian 11 Sep 85 p 3

LAPPO, S., Doctor of Physical-Mathematical Sciences, head of the Laboratory of Physics of the Ocean at the State Oceanographic Institute

[Abstract] The author describes the program called "Razrezy" (cross-sections) for the study of ocean-atmosphere interaction to gain a better understanding of short-term fluctuations in climate. It is recalled that the program is based on research done in the 1970s by academician G. I. Marchuk, which had the aim of compiling weather forecasts for a period of one to three months. As a result of his findings, Marchuk proposed that scientific expeditionary work be concentrated in certain identified energy-active zones of the world's oceans where the exchange of heat between ocean and atmosphere is most intensive. The program was undertaken by the Soviet Union in 1981, and it has been joined by scientists of East Germany, Bulgaria and Poland. It was initially slated for five years, and it has been decided to extend it for another five years, according to the author.

The author explains that the main goals of the program are to study climatic processes of the large-scale interaction of the atmosphere, ocean and continents in regions of energy-active zones; to study temporary variability of basic characteristics of the ocean and atmosphere in energy-active zones; and to study the connection between thermal and dynamic anomalies in these zones and also the formation of air-circulation anomalies above the ocean and continents. Since 1981, expeditions reportedly have made observations in every season in survey areas having maximum dimensions of 1,500 by 2,000 kilometers. The following energy-active zones and the organizations which are responsible for studying them are identified: the Norwegian-Greenland zone--the Arctic and Antarctic institutes; the Newfoundland zone--the State Oceanographic Institute; the Gulfstream Current zone--the USSR Academy of Sciences' Institute of Oceanology; the Atlantic tropical zone--the USSR Academy of Sciences' Marine Hydrophysical Institute; and the Japan Current zone--the Far East Regional Scientific Research Institute.

The observations conducted in the energy-active zones are said to involve a complex of oceanographic, meteorological, radiation and aerological studies from research ships, airplanes and satellites.

FTD/SNAP
/5915
CSO: 1865/41

HYDROPHYSICAL EXPERIMENT 'MEZOPOLIGON-85' IN TROPICAL ATLANTIC

Moscow VODNYY TRANSPORT in Russian 1 Oct 85 p 4

TITOV,V., Candidate of Geographic Sciences, deputy head of the expedition of the USSR Academy of Sciences' Institute of Oceanology

[Abstract] The author comments on the organization and results of a hydrophysical experiment called "Mezopoligon-85", which was conducted during a large expedition of the USSR Academy of Sciences' Institute of Oceanology. The expedition was undertaken in line with the scientific program called "Mezopoligon", which was drafted at the institute. Problems of the interaction of large synoptic eddy currents and the water surrounding them are being studied in line with this program.

The author relates that a survey area 220 kilometers square in the tropical Atlantic was selected for the experiment. Three research ships took part in the expedition: the "Vityaz" which belongs to the oceanology institute's southern branch in Gelendzhik, and the "Akademik Mstislav Keldysh" and "Akademik Kurchatov" of the institute's Atlantic branch in Kaliningrad. During the period from March through June of 1985, hydrophysical readings were taken six different times at points spaced 10 miles apart in a grid pattern over the survey area. Physical and chemical properties of the water were measured from the surface of the ocean down to 1,500 meters. The expedition also deployed 76 self-contained anchored buoy stations over the survey area. Each of these stations consists of a foam-plastic cylindrical buoy which can hold 2.3 tons. The buoy's steel anchor line is 5,500 to 6,000 meters long. Special instruments are attached to the line at certain intervals of depths. These instruments automatically take hydrologic readings and record them on magnetic tape. After 35-38 days, the stations were picked up and the recorded data were processed on shipboard computers.

The author reports that two large eddy currents were found in the survey area as a result of the experiment. Each of them is approximately 80 miles in diameter, and they rotate in opposite directions and touch each other. Also, in the layer of ocean between the 900- and 1,300-meter levels, the expedition discovered a kind of 'lens' of a water mass about 30 miles in diameter, whose properties were completely different from those of the surrounding water.

The author calls the scale of the experiment "Mezopoligon-85" without precedent in world oceanology, and reports that a new expedition of this type is scheduled for December of this year, in the Pacific Ocean.

FTD/SNAP
/5915
CSO: 1865/41

UDC 551.465.4

SEASONAL SOURCES OF THERMOHALINE CIRCULATION IN NORTH ATLANTIC

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 282, No 3, May 85
(manuscript received 14 Aug 84) pp 705-708

GALERKIN, L. I., MONIN, A. S., corresponding member, USSR Academy of Sciences, and SERGUNIN, S. V., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Due to the very great thermal and mechanical inertia of the ocean both the diurnal and seasonal variations of temperature and currents over most of the ocean are small, but some characteristics experience considerable seasonal variations, especially the effect of the atmosphere on the ocean: vertical flows of heat and salt at its surface and especially their combination: $M = J - \alpha/C_w H$, representing the vertical flow of mass, describing the sources of thermohaline ocean circulation. The first and only map of M values (Ye. G. Agafonova, et al., OKEANOLOGIYA, Vol 12, No 6, 1972) was based on the mean annual components of the heat and water budgets of the ocean surface. Continuing such work, the article gives the results of computations of the annual variation of M values in 11 5° grid squares in the main currents, in dynamic zones and on the periphery of the subtropical anticyclonic circulation in the North Atlantic on the basis of mean monthly long term P (rate of falling of precipitation), R (radiative heat flow), relative humidity f, wind speed u, water and air temperatures (T_w, T_a) values. The results of the computations are tabulated. The computed monthly values of the vertical flow of mass M characterizing buoyancy of ocean surface waters were almost everywhere negative in winter and positive in summer and therefore their mean annual values are not representative, always being below the actual extrema. It is noted that earlier computations based on mean annual meteorological data considerably exaggerated the mean annual M values and sometimes even distorted their signs, indicating that the role of seasonal variations is extremely great. Figures 1, tables 1; references 5 Russian.
[400-5303/5915]

UDC 550.4:553.495

MECHANISM OF FIXATION OF Mn and Fe ON SURFACE OF FERROMANGANESE NODULES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 282, No 3, May 85
(manuscript received 25 Sep 84) pp 688-692

MOROZOV, A. A., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] As yet there is no unanimous opinion with respect to the mechanism of binding of the components of ore matter into the consolidated solid body of an Mn-Fe nodule, but is is unquestionable that colloidal-chemical, sorption and redox (chemical and microbiological) processes are involved. However, it appears that the formation of the Mn component of pelagic nodules occurs primarily from solid phase matter, specifically hydrated MnO_2 received as a result of sedimentation. Under pelagic sedimentation conditions the formation of ferromanganese nodules is a process of binding of exceedingly highly disperse particles and alumosilicates which in the water medium have well-expressed electrical surface properties. This is indicative of a colloidal-chemical activity of the received material and suggests that this activity is an indispensable part of the mechanism of formation of the ore body of the nodules, although each of the main components of the ore matter can manifest its own surface activity. The formation of the nodules can be attributed to the specifics of the chemical properties of Mn forms existing in the ocean: Mn(II) and MnO_2. The structure of colloidal-disperse particles of hydrated MnO_2 and their fixation on the nodule surface were studied in great detail. The various factors involved in nodule formation are reviewed and a number of possible variants are considered. A model of the mechanism of formation of the nodule ore body is proposed. Since the solid phases of Fe-Mn nodules and disperse particles of Mn and Fe hydroxides in the slightly alkaline medium have the same negative surface charge, a necessary condition for chemical interaction between them is a change in the electrical and chemical properties of one of the contacting surfaces. Such a condition can arise due to the appearance of reduced forms of Mn and Fe, whose hydroxides, in contrast to hydroxides of oxidized forms, have a well-expressed basic character. A positive charge appears on the surface. This gives rise to the possibility of electrostatic attraction, contact and chemical redox interactions between different Mn and Fe forms. Figures 1; references: 4 Russian.
[400-5303/5915]

UDC 550.42

NUCLEAR PHYSICAL METHODS FOR DETERMINING CARBON IN OCEANIC SUSPENSIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 282, No 3, May 85 (manuscript received 6 Jun 84) pp 587-590

BARIT, I. Ya., KUZMIN, L. Ye. and SHNYKIN, B. A., Nuclear Research Institute, USSR Academy of Sciences, Moscow

[Abstract] The article describes nuclear physical methods for determining the total carbon content in oceanic suspensions using the reactions $^{12}C(d, p)^{13}C$ and $12C(d, n)^{13}N$. The methods are based on new techniques for preparing samples for analysis involving a transfer of suspended matter from the filter onto a metallic backing with a low C content by pressing and subsequent removal of the filter. The method was used in work with the range of suspension densities $q = 0.1\text{-}1.0$ mg/cm^2. Most of the suspended matter is transferred onto the metal backing. The suspended matter consists of two usually non-equivalent fractions, biogenous and terrigenous, whose particles have a different capacity for adhesion to the filter material (the completeness of transfer of each fraction was evaluated using the indicator elements N and Al). It was found that the transfer was complete. However, in the transfer process (especially in the case of small q) contamination of the metal backing by filter material is possible. A procedure was developed to ascertain if and when this occurs. The results of determination of C content in suspension samples are given (C content, % by mass, found by nuclear physics analytical methods and by chemical analysis). The tabulated data contain a correction for pollution by the backing (contamination factor). Figures 3, tables 1; references 7: 6 Russian, 1 Western.
[400-5303/5915]

UDC 534.24:551.463.2

FLUCTUATIONS IN PROPAGATION TIME AND DIRECTION OF ARRIVAL OF SIGNAL REFLECTED FROM WAVE-COVERED SEA SURFACE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 7, Jul 85 (manuscript received 25 Aug 83) pp 768-774

FROLOV, V. M., Acoustics Institute imeni N. N. Andreyev

[Abstract] The two-dimensional problem of finding fluctuations in propagation time, angle of arrival and intensity of sound experiencing multiple reflection from the surface of a stratified ocean was solved by the author in an earlier study (AKUST. ZHURN., Vol 31, No 1, pp 103-110, 1985). Continuing work along these lines, a study was made of a three-dimensional case of single reflection in a geometroacoustical approximation with ray refraction neglected. The objective was to develop a method for determining the parameters of the wave-covered sea surface. The rays arriving at a detector after reflection from the surface and gently sloping irregularities arrive from different directions,

each ray corresponding to a glitter spot, a reflection from a surface sector for which the condition of equality of the angles of incidence and reflection is satisfied. Under definite conditions a situation can arise when a single glitter spot is registered at the observation point (the spot lying closest to the sea surface point corresponding to mirror reflection from the undisturbed surface). Formulas are derived for determining the averaged characteristics of a signal arriving at a directional antenna from such a spot: fluctuations of signal propagation time and the direction of its arrival and the spatial-temporal correlation of these characteristics. A number of simplifying assumptions are made (for example, the surface is statistically uniform). Cases of incidence of spherical and plane waves on the scattering surface, as well as a narrow collimated beam, are examined. Numerical estimates are made. Recommendations are given on determination of the characteristics of sea waves from measurements of these fluctuations. Figures 2; references 11: 10 Russian, 1 Western.
[456-5303/5915]

UDC 551.465.1

INFLUENCE OF TAYLOR-HOGG CONE ON DENSITY FIELD STRUCTURE IN STRATIFIED OCEAN WITH PYCNOCLINE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 7, Jul 85 (manuscript received 19 Jan 84, after revision 4 May 84) pp 752-758

TIMONOV, M. B. and SHELKOVNIKOV, N. K., Moscow State University

[Abstract] Study of hydrodynamic anomalies over localized bottom relief irregularities is dictated by the need for finding new biologically productive regions of the ocean. This problem is examined for a model of the ocean in which a well-expressed density jump layer separates uniform and stratified layers. This model approximates stratification in tropical and subtropical regions of the ocean where a stable and well-expressed seasonal pycnocline exists throughout the year. The model is also suited for studying the influence of anticyclonic vorticity over a localized underwater obstacle on the position of the seasonal pycnocline, important for explaining in situ observational data and revealing the existence of hydrodynamic anomalies over banks. The specific problem formulated is as follows: determination of the nature of pycnocline deformation arising during flow of a westerly current without velocity shear around an underwater obstacle in a two-layer ocean with a stratified lower layer. The influence of stratification of the lower layer, density drop in the pycnocline and ratio of thicknesses of the upper and lower layers on pycnocline position was studied. It was found that the isolines of the functions for disturbances of the pycnocline and density field in the lower layer do not coincide with the isolines of the stream function. Pycnocline deformations are also observed when the flow contains no closed stream lines (Taylor-Hogg cone). It is shown that rising of the pycnocline over an underwater obstacle is caused to a considerable degree by the existence of a region of anticyclonic vorticity above it; pycnocline deformation is very significant and therefore is easily detected. This effect can be used in study of Taylor eddies in the ocean and in determining promising fishing areas. Figures 3; references 9: 5 Russian, 4 Western.
[456-5303/5915]

UDC 517.958+551.466.44

MASLOV OPERATOR METHOD IN PROBLEM OF WAVES IN WATER GENERATED BY SOURCE MOVING OVER UNEVEN BOTTOM

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 7, Jul 85 (manuscript received 14 Feb 84) pp 744-751

DOBROKHOTOV, S. Yu. and ZHEVANDROV, P. N., Moscow State University; Moscow Civil Engineering Institute

[Abstract] A wedge of waves behind a source moving over a fluid surface is a result of the Cerenkov radiation of waves in a dispersive medium. The simplest mathematical model describing such a phenomenon is a system of linear differential equations in which the moving source is represented in the form of a Dirac delta function. In a homogeneous medium, but for waves in water at a constant depth, the coefficients in the corresponding equations are constant and after application of the Fourier or Laplace transforms they are reduced to ordinary differential or algebraic equations. But in the case of variable parameters of the medium use of the Fourier transform does not give satisfactory results. The problem of Cerenkov radiation of waves in water involves a system whose precise or approximate solution is impossible. If the depth changes slowly the waves generated by the source are short in comparison with the characteristic scale of depth change. In such a case asymptotic formulas can be used for describing Cerenkov radiation. These formulas can be derived using certain "nonstandard" characteristics as defined by V. P. Maslov (UMN, Vol 38, No 6, pp 3-36, 1983). Later in OPERATORNYYE METODY, Moscow, Nauka, 1973, V. P. Maslov developed a method reducing construction of the asymptotic form of solution of the initial problem to an analytical or numerical solution of systems of ordinary differential equations in partial derivatives. Applying the Maslov approach, the authors give examples of computation of wave patterns during motion of a source over some specific bottom profiles along different trajectories. Figures 2; references 18: 15 Russian, 3 Western.
[456-5303/5915]

UDC 551.465.72/73

EVALUATION OF COEFFICIENTS OF HEAT AND MOISTURE EXCHANGE BETWEEN OCEAN AND ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 7, Jul 85 (manuscript received 10 May 83) pp 735-743

YEFIMOV, V. V., TIMOFEYEV, N. A., SYCHEV, Ye. N. and KURZHEYEVSKIY, I. V., Marine Hydrophysical Institute, Ukrainian Academy of Sciences

[Abstract] The heat budget of the Black Sea was determined by generalization of about 60,000 series of standard shipboard hydrometeorological observations carried out between 1891 and 1966, supplemented by additional archival data for 1967-1975 and all hydrological information collected between 1880 and 1973. The mean monthly and annual values of components of the external heat budget

were computed for 60 elementary squares (1° in latitude x 1° in longitude) and then averaged for the entire area of the Black Sea (a table gives the mean monthly and annual values of the meteorological characteristics for the entire area of the Black Sea for the period up to 1975; a figure gives the vertical profiles of averaged temperatures for four seasons of the year). The tabulated and integrated data for flows of momentum, heat and moisture between the ocean and atmosphere are compared with corresponding values obtained using standard formulas. It was found that there is an understatement of the fluxes of heat and moisture computed using these formulas in comparison with the experimental data. Accordingly, values are proposed for the constant components and computation formulas are proposed for the variable exchange coefficients which are most consistent with in situ data. Figures 3; tables 4; references 18: 15 Russian, 3 Western.
[456-5303/5915]

UDC 550.312:550.83:551.24(241/.246)

ESTIMATING DENSITY INHOMOGENEITY OF UPPER MANTLE UNDER ATLANTIC OCEAN USING DATA FROM COMPREHENSIVE REGIONAL GEOPHYSICAL RESEARCH

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 5, May 85
(manuscript received 20 Apr 84) pp 93-103

LADYNIN, A. V., LITVINOV, E. M. and MASHCHENKOV, S. P., Geology and Geophysics Institute, Siberian Department, USSR Academy of Sciences, Novosibirsk; All-Union Oceanology Scientific Research Institute, Leningrad

[Abstract] In GEOLOGIYA I GEOFIZIKA, No 6, 1973 A. V. Ladynin gave a review of ways to estimate lateral density inhomogeneities in the upper mantle and presented a method for determining density in the lithospheric layer between the crust and asthenosphere, a method based on comparison of real thickness of the crust and its isostatic model. A study is made of density inhomogeneity of the Atlantic Ocean upper mantle based on the mentioned method, supplemented by a method published in GEOLOGIYA I GEOFIZIKA, No 7, 1983, developed for estimating asthenospheric density. Since isostasy prevails virtually everywhere, crustal structural inhomogeneities detected by deep seismic sounding; seismology and gravimetry, together with upper mantle inhomogeneities, are mutually compensated (a constant balance of crustal and upper mantle masses is maintained in a lateral direction). It is shown that having a density model of the crust it is also possible to evaluate lateral variations of upper mantle density. Isostatic regulation of the lithosphere to a large extent is attributable to the flow of asthenospheric material. The main role in upper mantle density structure is played by inhomogeneities of its lithospheric part, but asthenospheric inhomogeneities must also be taken into account. With these factors taken into account, data on bottom bathymetry, seismic data on crustal structure, gravimetric and geothermal materials are used in plotting and analyzing a series of maps: crustal thickness under Atlantic Ocean; coefficients for compensating Atlantic Ocean bottom relief masses; corrected depths of Moho in isostatic model; density distribution in upper mantle lithospheric layer; lateral changes in asthenospheric density. Figures 5; references 16: 15 Russian, 1 Western.
[418-5303/5915]

UDC 551.242.2(267.5)

STRUCTURE OF SEDIMENTARY COVER OF RED SEA DETERMINED FROM SEISMIC DATA

Moscow GEOTEKTONIKA in Russian No 4, Jul-Aug 85
(manuscript received 9 Feb 83) pp 110-122

YELNIKOV, I. N. and ZONENSHAYN, L. P., Southern Division, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] The materials examined in the article are the results of seismic studies carried out by the Red Sea expedition, Oceanology Institute, in 1979-1980 from aboard the "Professor Shtokman." Work was done by the continuous seismic profiling method in a region of detailed study of the Red Sea rift (18°N) and on regional runs along the edges of the Red Sea rift and across it to the south and north of the region 18°N (the studied area is shown on a map). There are clearly defined southern and northern parts of the sea. The southern part (south of 20°N) has a well-expressed zonality in structure of the sedimentary cover. Evaporites have developed along the edges of the Red Sea depression and are absent in a central zone with a width of about 50 km and an extent not less than 750 km. Only the upper, Pliocene-Quaternary sedimentary stratum with a thickness up to 300 m has developed in this central zone. Within it there is a narrower (4-5 km in width) axial rift zone without significant thicknesses of sediments. There are three zones in the cross section of the southern part of the Red Sea rift which coincide well with tectonic zonality in the rift. The marginal parts, underlain by evaporites, for example, correspond to more ancient parts of the rift formed during the first phase of spreading; its central part, without evaporites, corresponds to the younger bed of the rift formed during the second phase of spreading; the narrow axial zone, without sediments, coincides with the zone of the most recent volcanism and most recent dilatation. The fundamental difference between the southern and northern parts of the Red Sea is that in the south the thick evaporite layer, due to spreading, was broken, whereas in the north it was not. Figures 6; references 12: 5 Russian, 7 Western.
[444-5303/5915]

UDC 551.242.2

PATTERNS OF RELATIVE POSITIONING OF OCEANIC RIFTS AND TRANSFORM FAULTS

Moscow GEOTEKTONIKA in Russian No 4, Jul-Aug 85 (manuscript received 29 Mar 84) pp 100-109

BOCHAROVA, N. Yu., MIRLIN, Ye. G. and POPOV, K. V., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences

[Abstract] The relative positioning of rift zones and transform faults determines the geometry of the axis of spreading of oceanic lithospheric plates. There is still no unified picture of the distribution of quantitative characteristics of the geometry of the spreading axis in all the oceans. Analysis of these parameters in a wide range of rates of spreading of plates is important

because they are closely related to the process of formation and evolution of the oceanic lithosphere. The authors accordingly sought to ascertain the general patterns of relative arrangement of rift zones and transform faults in the ocean. The initial materials for the study are fully reviewed. The geological-geophysical materials for the crests of mid-oceanic ridges fall into three categories: data on structure of oceanic rift zones and transform faults obtained in recent years using new technical apparatus; bathymetric and geophysical maps for regions explored in detail (such test ranges number 38), for which the distance between runs is 5-20 km, used for maps at 1:500,000-1:100,000; bathymetric maps at 1:2,000,000 and 1:5,000,000. These materials were used in determining the parameters of 360 active transform faults (50 in the Arctic, 212 in the Atlantic, 45 in the Indian Ocean, 53 in the Pacific). The quantitative characteristics of each of these faults were catalogued. Distance between transform faults was determined; lengths of active parts of these faults were ascertained; the angular relationships between rift zones and transform faults were calculated. It is concluded that the distribution of the quantitative characteristics of the geometry of the axis of spreading of plates in the ocean is clearly dependent on the spreading rate. The thermal regime of the lithosphere exerts a decisive influence on the geometry of the axis of spreading of plates. Figures 3, tables 1; references 34: 7 Russian, 27 Western.
[444-5303/5915]

UDC 534.28

ACOUSTIC FIELD IN UNDERWATER WAVEGUIDE WITH RANDOM INHOMOGENEITIES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 31, No 3, May-Jun 85
(manuscript received 22 Nov 83) pp 358-364

NECHAYEV, A. G., Applied Physics Institute, USSR Academy of Sciences

[Abstract] In the case of propagation of low-frequency sound (50-500 Hz) over great distances in the ocean (10^2-10^3 km) it is essential to take into account multiple scattering of the acoustic field on large-scale random inhomogeneities, such as on internal waves. However, the equations used for the second statistical moments of the amplitude of normal waves (such as by L. B. Dozier, et al. in JASA, Vol 63, No 2, 1978) suffer from a number of inadequacies. These equations were derived on the assumption of a reciprocal incoherence of modes, resulting in a loss of information on the interference structure of the acoustic field. Moreover, such equations do not make it possible to examine the correlation characteristics of sound. In an earlier article (IZV. VUZov: RADIOFIZIKA, Vol 26, No 4, 1983) the author proposed a method for deriving a system of equations for the moments of amplitudes of normal waves in a waveguide with an uneven upper boundary and in a waveguide with volumetric inhomogeneities which describes both the interference structure and correlation properties of the field. In this article this approach, based on representation of the acoustic field in the horizontal plane in the form of a wave beam and using the approximation of a Markov random process, is applied to an analysis of signal propagation in an underwater waveguide with random volumetric irregularities. It is shown that with a large number of pairs of

modes satisfying the synchronism condition the interference structure is determined not only by the mean field, but also by partial coherence of the random components of normal waves and because of this attenuates to a considerably lesser degree than the coherent field. Under certain conditions, however, the interference structure is determined only by the coherent field. References 12: 9 Russian, 3 Western.
[398-5303/5915]

UDC 534.222.2

DETERMINING UNIVERSAL HIGH-FREQUENCY ASYMPTOTIC SPECTRAL FORMS ASSOCIATED WITH PROPAGATION OF INTENSIVE ACOUSTIC NOISE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 31, No 3, May-Jun 85
(manuscript received 6 Jan 84) pp 303-308

BJORNO, L. and GURBATOV, S. N., Danish Technical Institute; Gorkiy State University

[Abstract] A theoretical and experimental study was made of the process of appearance of high-frequency asymptotic forms of the energy spectrum of noise in media with weak dispersion and attenuation. The theoretical results are compared with experimental data on the propagation of intensive acoustic noise in air-filled pipes where the appearance of dispersion is associated with the influence of near-wall viscosity. It is shown that there is a power-law dropoff of the spectrum which is associated with field characteristics. Analysis of data on transformation of the noise spectra in different sections indicates that first a universal high-frequency spectral form appears which is displaced in the direction of the lower frequencies as the wave propagates. In this process it is possible to observe the appearance of some universal spectral form and a loss of information on fine structure of the spectrum in an ever-broader frequency range. It can be postulated that the experimentally observed transformation of the spectrum is the initial stage in appearance of a self-similar structure of the spectrum of intensive acoustic noise. However, full self-similarity is not established due to the limited character of the interaction region. Figures 4; references 18: 10 Russian, 8 Western.
[398-5303/5915]

UDC 532.529

DIFFERENTLY DIRECTED MOVEMENTS OF GAS BUBBLES IN VIBRATING FLUIDS IN PRESENCE OF PHYSICAL INHOMOGENEITIES

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 21, No 6, Jun 85
(manuscript received 28 Feb 84) pp 100-107

PELYKH, N. A., Mechanics Institute, Ukrainian Academy of Sciences, Kiev

[Abstract] With certain vibrational acceleration values gas bubbles in a fluid do not float to the surface but penetrate into the depths of the fluid. There are some quasistationary positions of equilibrium of bubbles where the

Archimedes force is equal to the force causing bubbles to sink. This problem requires further study and the author examined the selective behavior of bubbles of different sizes. An analysis was made of the joint influence of such parameters as the surface tension coefficient, bubble radius, density of carrier medium, frequency of vibrational excitation, as well as the index of polytropic processes for the internal cavities of bubbles, on the possibility of the existence of differently directed movements of gas bubbles in an ideal incompressible fluid. This made it possible to broaden some conclusions concerning the qualitative peculiarities of these phenomena. A study was made of a multiphase medium constituting a mixture of gas inclusions of different sizes in a carrier fluid of a given density filling a rigid vessel which experiences oscillations in a longitudinal direction. A study was made of the dynamic behavior of bubbles of two sizes relative to a noninertial coordinate system. A series of simplifying assumptions was made. An experiment was carried out using a transparent cylindrical vessel with a homogeneous fluid or two unmixing fluids of different density (distilled water, kerosene). Two-channel adjustable microcompressors were used as a continuous source of gas bubbles. A vibrating stand was used for exciting motion of the vessel, carrying fluid and gas. Syringes were used in introducing controllable air volumes into the upper or lower fluid or one of them. This made it possible to obtain flows of bubbles with the desired frequency of formation. Changes in the direction of movement of the bubble flow were achieved by varying the vibrational acceleration of the stand and the position of the syringes. The observed changes were registered in a photographic survey. It is shown that a repulsion level exists in one of the layers of fluid. Bubbles of identical size situated close to this level on either side either float up or sink to the bottom. In the case of motion of bubbles greatly differing in size, the initial position of bubbles of different size is the same but their behavior is different. Small bubbles sink whereas large bubbles float up. Figures 3; references 11: 9 Russian, 2 Western.
[425-5303/5915]

TERRESTRIAL GEOPHYSICS

KYZYL-KUMY SUPERDEEP BOREHOLE REACHES 1,000-METER MARK

Leningrad LENINGRADSKAYA PRAVDA in Russian 17 Jul 85 p 1

[Text] Uzbek SSR--The first thousand meters have been passed into the earth's depths at the Kyzyl-Kumy superdeep geological-survey borehole. Personnel of the Muruntau Geological Surveying Party of the Uzbek Petroleum and Gas Geology Association are drilling the superdeep borehole, which is the first of its kind in Central Asia. Plans call for sinking the borehole to the 7,000-meter mark. This will make it possible to obtain information on mineral resources in the region, as well as new data that are needed for studying the structure and composition of the earth's crust.

(The photograph showed the drilling rig and buildings at the borehole site.)

FTD/SNAP
/5915
CSO: 1865/453

WORK ON GEOLOGICAL ENVIRONMENT OF EARTHQUAKES

Frunze SOVETSKAYA KIRGIZIYA in Russian 5 Jul 85 p 4

[Article by V. Vadimov]

[Text] As is known, Kirgizia is located in a zone of high seismic activity. As many as 150 earthquakes of various intensities take place on its territory each year. Therefore the formulation of criteria for comprehensive methods of forecasting the time, place and intensity of potential earthquakes is a most important direction of the work of the Kirgiz Academy of Sciences' Institute of Seismology.

THE GEOLOGICAL ENVIRONMENT OF THE OCCURRENCE OF EARTHQUAKES IN KIRGIZIA (GEOLOGICHESKAYA SREDA VOZNIKOVENIYA ZEMLETRYASENIY V KIRGIZII), a collective work by seismologists which have been published by Academy's publishing house "Ilim", is a contribution to work on these problems. This work deals with relationships between the location and intensity of earthquakes and various elements of the geological structure of their environment.

The work elaborates assumptions which help to expand the capabilities of seismotectonic analysis and make it more comprehensive and valuable. And this will ultimately lead to the compilation of maps for general and detailed seismic zoning that are more reliable and of higher quality.

FTD/SNAP
/5915
CSO: 1865/453

GEOCHEMISTRY DISCOVERY OPENS WAY TO NEW MINING OF RARE METALS

Moscow MOSKOVSKAYA PRAVDA in Russian 20 Sep 85 p 1

[Article by Sh. Muladzhanov]

[Exerpt] Yesterday the USSR State Committee on Inventions and Discoveries recorded a major scientific discovery. Its authors are the Moscow scientists A. A. Beus, V. I. Kovalenko, L. N. Kogarko, V. S. Kurdrin, D. A. Mineyev and A. A. Sitnin, and B. Luvsanzandan, who is a member of the Academy of Sciences of the Mongolian People's Republic.

Substances which until quite recently had no practical applications are now needed more and more by science and industry. Today they are needed for instrument building and electronics, for the radio industry and chemistry. The demand is growing, but it has not become any easier to mine elements such as tantalum and yttrium. Where have they been found up until now? Aluminum, which is so essential to industry, has been found in feldspars, for example. Feldspars are very common, but in their crystalline lattices, aluminum is firmly bound with silicon, and great cost is involved in breaking this bond and obtaining pure material. Industry needs aluminum alone, just as it needs tantalum alone, without niobium. The same is true for other pure minerals. It was formerly thought such minerals could be found only in relatively small vein formations.

The present discovery represents the culmination of 25 years of intense geochemical studies. Scientists painstakingly analyzed the nature of separation of analog-elements that make up those same hard-to-separate pairs (niobium-tantalum, aluminum-silicon, etc.). A series of unique experiments was conducted. Step by step the geochemists came to the hypothesis which was subsequently confirmed: large agglomerations of many rare and even ultra-rare elements must exist.

The theoretical calculations and hypothesis were followed by a period of specific geological investigations. The scientists discovered objects with maximum separation of many rare analog-elements, with agglomerations of tantalum, yttrium and other rare-metal elements that were previously unknown to science.

The practical importance of the discovery is extremely large. In essence, scientists have radically changed the direction of exploratory and geological

survey work aimed at finding rare metals. New commercial types of ores have appeared in the arsenal of the extraction industry. Major commercial-scale deposits of tantalum, zirconium and other rare metals have been marked on maps of the USSR, Mongolia and other countries.

FTD/SNAP
/5915
CSO: 1865/41

RADIOMETRIC AIRBORNE MOISTURE METER

Moscow TRUD in Russian 19 Jul 85 p 4

[Article by M. Gusev (Saratov)]

[Excerpt] Young physicists of the Saratov affiliate of the USSR Academy of Sciences' Institute of Radio Engineering and Electronics have developed an instrument which permits accurate recording of the presence of moisture in the ground from an airplane.

The moisture meter makes it possible to determine the amount of moisture in the ground with a precision of 4 percent.

"Our instrument can also determine the ground water level," explained A. Antopchenko, head of the flight contingent of a hydrogeological land-reclamation party.

The moisture meter has already done a considerable amount of useful work in the course of its career, which began recently. In Astrakhan Oblast, 150,000 hectares of farmland have been studied. With the aid of the meter, scientists in Kalmykia established the reasons for the flooding of three settlements with ground water and discovered the place where it was accumulating.

"Any heated body emits a broad spectrum of electromagnetic radiations," explained O. Saparin, an engineer. "As the temperature of the ground changes, changes also occur in the boundaries of this spectrum and the ground's radiation-brightness temperature. It will vary in accordance with the amount of moisture. It is this temperature that we measure."

FTD/SNAP
/5915
CSO: 1865/41

OPTICAL CABLES FOR TAKING READINGS FROM BOREHOLES

Frunze SOVETSKAYA KIRGIZIYA in Russian 25 Sep 85 p 2

[Article by A. Skorobogatov, correspondent (Tashkent)]

[Excerpt] The "Tashkentkabel'" Plant has mastered the production of optical cables.

"Light is capable of transmitting an incomparably greater volume of information than radio waves," explained Candidate of Technical Sciences V. Andronov, the plant's chief engineer.

In response to an order placed by the All-Union Scientific Research Institute of Nuclear Geophysics and Geochemistry of the USSR Ministry of Geology, the Tashkent electrical equipment makers have already set up the production of optical geophysical cables. The glass filament of such a cable is sheathed in polyethylene and then in a casing made of special wire. Such a cable can be wound on a reel like an ordinary cable, and it is capable of supporting several kilograms of payload--geophysical instruments and data transmitters. These optical-fiber cables make it possible to dispense with the costly and laborious method of studying minerals in the ground by means of core samples.

The plant also has begun the manufacture of an optical telephone cable 4.5 kilometers long. It will link two Tashkent automatic telephone exchanges. It is planned to connect the republic's computer centers with such lines.

FTD/SNAP
/5915
CSO: 1865/41

THEORY OF FIELD PROPAGATION ADVANCES MHD PROBING OF EARTH'S CRUST

Moscow IZVESTIYA in Russian 11 Sep 85 p 3

[article by M. Savin, Candidate of Physical-Mathematical Sciences (Khabarovsk)]

[Excerpt] The capability of magnetohydrodynamic generators to develop unprecedented power surges in seconds has proved to be very useful for geophysicists. With a MHD generator it is possible to probe the earth's crust to a depth of 50 kilometers.

In the same way that light is reflected from various surfaces, the generator's penetrating field is reflected from deep-level geophysical boundaries and carries information about them to the earth's surface.

In experiments a compact unit mounted on a "KrAZ-257" motor vehicle is prepared for operation. A plasma stream is 'shot' with a roar from the MHD channel for a distance of several dozen meters.

The pulsed current sent through grounded electrodes which are connected by a cable 15 kilometers long creates a superpowerful electromagnetic field in the depths of the planet. This field illuminates the subterranean levels like a bright 'flash'. Receiving stations which record pulses reflected from the geophysical boundaries are set up in a radius of up to 100 kilometers. The 'eyes and ears' of these stations consist of apparatus that is not so complex--ordinary coils with current or electric sensors.

But the picture of the earth's crust still has to be read, that is, the curved lines must be interpreted. In recent years, thanks to the creative collaboration of scientists of the computer centers of the Siberian Branch and of the Far East Research Center of the USSR Academy of Sciences, a mathematical theory of the propagation of pulsed electromagnetic fields in the material of the earth's crust has been constructed. The task now at hand is for geophysicists to develop this theory into a working method.

Interpretation of the results from geophysical MHD generators will provide science with a wealth of reliable information on physical properties of the lower levels of the earth's crust. It is possible to 'look' into even greater depths of the planet--the mantle--by studying variations of the earth's natural electromagnetic field. An advanced version of this method has been proposed by Professor D. Chetayev.

Academician Ye. Velikhov, vice-president of the USSR Academy of Sciences, nurtured the first geophysical MHD generators through their infancy. He initiated their use in the Urals region, the Kola Peninsula, the Pamir Mountains, and in Astrakhan Oblast. The first important geological results were obtained in the Astrakhan Anticline, where it became possible to reduce substantially the number of dry wells in drilling for oil and natural gas.

We believe that it is now very important for the arsenal of geophysicists in the Far East to be augmented with MHD generators. The peaceful shots from the 'geophysical cannons' may provide new data on oil and gas deposits.

FTD/SNAP
/5915
CSO: 1865/453

EXPERIMENTS TO RECORD GRAVITONS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Jul 85 p 4

[Excerpt] If experiments which scientists are conducting yield a positive result, the possibility of creating a gravitational laser, or so-called graser, may ultimately be confirmed. Our correspondent S. Glukhov asked Doctor of Physical-Mathematical Sciences U. Kopvillem of the USSR Academy of Sciences' Far East Research Center, who is one of the originators of this idea, to tell about it.

"There have been sensational reports to the effect that the earth experiences harmonious seismic oscillations of unexplained origin. It has been mentioned that their frequency [may be] a multiple of the frequencies of oscillations of pulsars near our planet. Could these mysterious signals be from outer space?"

"An answer to this question was provided by an experiment which we conducted off the coast of the Far East, in Peter the Great Bay. An optical deformation gauge--a tube 105 meters long--was laid between Stenin Island and Cape Shultz. The thin beam of a laser placed inside it would move, naturally, at the moment the earth did. Thanks to a high vacuum, it was possible to record the deflection of the laser beam at the opposite end of the tube with extraordinary--hundreds of millionths of a centimeter--accuracy. After such precise measurements were made, we had no doubts: the periodicity of the recorded signals clearly indicated that the source was of extraterrestrial origin. The nature of the signals would have been difficult to explain if it was not postulated that the effects were the result of gravitational waves generated by pulsars."

"Waves of gravitons?"

"Let us not hurry, we'll get back to outer space. Right now, I should say something about the idea of the graser, which originated with our physicist V. Nagibarov.

"In the 1960s, scientists began experiments to discover gravitational waves, which presumably could be emitted by pulsars. Regarding prospects for producing gravitons in the laboratory, specialists were altogether skeptical.

"But Nagibarov and I were bold enough to include in our project an attempt to produce and record gravitons in laboratory conditons. I'll try to explain the essence of our experiment. If a laser illuminates a massive transparent

body, its atoms begin to resonate--to oscillate at the same frequencies, at a billion million oscillations per second. This means that they move from their normal locations in relation to each other, even if it is so small a distance that it cannot be expressed. There occurs a kind of warping of space inside the body being illuminated. There is a 'gap' in space which becomes filled with adjacent sectors, and they in turn 'disturb' the next sector, and so forth, forming something like a tunnel from these empty spaces. To understand the process, think of a graser as a kind of shotgun shell: the powder is photons, and the shot is gravitons."

"How have colleagues reacted to your graser idea?"

"It has not gone unnoticed both in our country and abroad. After our paper on a gravitational laser was read at the USSR Academy of Sciences' Institute of Physics Problems, we were approached to talk about it by Academicians P. L. Kapitsa and Ya. B. Zeldovich, who were present."

FTD/SNAP
/5915
CSO: 1865/453

EARTH PHYSICIST DESCRIBES U.S. NUCLEAR TEST MONITORING SYSTEM

Moscow IZVESTIYA in Russian 23 Aug 85 p 5

[Abstract] The article is a lengthy interview with Academician Mikhail Aleksandrovich Sadovskiy, director of the USSR Academy of Sciences' Institute of Physics of the Earth, on U. S. capabilities for monitoring underground nuclear weapons tests in the USSR. The occasion of the article, as it is explained in an editorial preface to the interview, is the U.S. administration's refusal to follow the Soviet Union's lead in declaring a moratorium on conducting nuclear explosions for the remainder of 1985, and particularly the alleged contention of the U.S. that it is impossible to verify Soviet compliance with such a moratorium.

Sadovskiy responds at length to questions about U.S. technical means of monitoring Soviet nuclear weapons testing, and whether it is possible to conduct tests that could not be detected by these means. He comments on the worldwide seismic station network in 55 countries that the U.S. has available for seismic detection and measurement of underground nuclear explosions, and also the systems of seismic research observatories in 15 countries and seismic grouping stations in 12 countries. He mentions the advanced computerized data processing capabilities of these facilities. Regarding the level of capability of the U.S. seismic system for monitoring nuclear tests, Sadovskiy summarizes information from an article by Professors Sykes and Evernden in the October 1982 issue of SCIENTIFIC AMERICAN, in which they assessed the capabilities of detecting nuclear explosions in the USSR. He also comments on other, non-seismic means of monitoring, such as hydroacoustical means and recording of effects in the atmosphere, ionosphere, and the earth's magnetic field.

Concluding that national technical means of the U.S. and also of other countries are entirely reliable for detecting nuclear tests, Sadovskiy also comments:

"I would also like to emphasize that our national seismic system, which is located only on the territory of the USSR, is oriented [only] in the direction of the American continent, and in connection with this it enjoys less favorable conditions for monitoring nuclear explosions. Nonetheless, we believe that our national means are sufficient for verifying the cessation of underground tests of nuclear weapons. Therefore the solution of the problem of completely banning nuclear weapons testing does not depend on verification. It depends first of all on the policy of the United States. The present U.S. Administration, categorically refusing to introduce a ban on nuclear tests, is doing this because it is developing new-generation weapons, weapons of the 1990s..."

FTD/SNAP
/5915
CSO: 1865/453

UDC 550.42:553.065

RADON AS INDICATOR OF PERMEABILITY ZONES FOR STEAM HYDROTHERMS

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 85
(manuscript received 20 Apr 83) pp 78-82

ROZHKOV, A. M., Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] It is important to increase the efficiency in reconnaissance-exploration work for high-temperature waters, search for hidden centers of discharge of steam hydrotherms and choice of optimum sites for test holes. Rn is an indicator of modern hydrothermal processes and its distribution can be used in outlining the areal distribution of hydrotherms and also heat-conducting fissured zones. The article describes use of a soil emanation survey for these purposes. Work was done in the Nizhekoshelevskoye hydrothermal deposit, situated on the western slope of Koshelevskiy volcano in Southern Kamchatka, an area whose geological and hydrogeological conditions have been well studied. A hole whose drilling began in 1971 has yielded steam from depths of 170 and 700 m. This area may be promising for construction of a geothermal power station with a rated capacity of 30,000 KW. The individual profiles and small sectors of the areal survey do not make it possible to give a full picture of the patterns and distribution of radon anomalies over the entire area of the deposit. However, over the entire studied area the radon concentrations were greater than the background radon concentrations in soil air. Radon anomalies occupy more than half the tested area and coincide with a series of northwesterly faults. A distinguishing feature of these sectors is their concentric arrangement relative to the caldera. A map of radon anomalies accompanies the text. More information can be obtained by conducting gas and thermometric surveys jointly with an emanation survey. Figures 2, tables 2; references: 11 Russian.
[415-5303/5915]

UDC 528.71:551.21

EXPERIENCE WITH SURFACE IR SURVEY FOR ESTIMATING TEMPERATURE AND HEAT RADIATION OF THERMAL FIELDS OF MUTNOVSKIY VOLCANO (KAMCHATKA)

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 85
(manuscript received 15 Jun 83) pp 54-63

POLYAK, B. G., BEZUKH, B. A., KAFTAN, V. I., KUZMIN, A. I., KUZMIN, Yu. D., STELMASHOK, V. Ye. and TURKOV, V. P., Geology Institute, USSR Academy of Sciences; Physics Institute, Belorussian Academy of Sciences; Volcanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences

[Abstract] A surface IR survey method was developed for obtaining quantitative data on the heat regime of thermal fields associated with volcanic and hydrothermal activity. The method provides data on the spatial characteristics of geothermal activity within volcanic structures and hydrothermal systems.

including places where contact measurements cannot be made. A similar method has been used in Iceland, Italy and Japan. The IR survey was made on Mutnovskiy volcano, where the intensity of fumarole activity has already been evaluated by contact measurements. At its peak there is an extensive depression formed by two merging craters with diameters of about 1.5-2 km and with fumaroles. The heat fields on the inner walls of the funnel are inaccessible for contact measurements; wall steepness dictates use of a surface survey. The density of IR radiation was measured with the SMOG-1K IR radiometer designed at the Physics Institute, Belorussian Academy of Sciences (a photograph accompanies the text). Photographs were taken at the same time w. h a "Zenit-Ye" camera with a wide-angle objective. Observations were made from a distance of 7 m, at which the distorting influence of the atmosphere is quite small. This made it possible to obtain the first quantitative data for estimating total heat intensity of fumarole activity for Mutnovskiy volcano. The total intensity is evidently appreciably lower than assumed earlier. Figures 8; references 18: 11 Russian, 7 Western.
[415-5303/5915]

UDC 551.248.2(571.66)

NEOTECTONICS AND VOLCANISM IN EASTERN VOLCANIC ZONE OF KAMCHATKA

Moscow GEOTEKTONIKA in Russian No 4, Jul-Aug 85
(manuscript received 26 Sep 83) pp 78-87

FLORENSKIY, I. V. and TRIFONOV, V. G., Geology Institute, USSR Academy of Sciences

[Abstract] A study was made of the relationship between Quaternary volcanoes and different elements of the present-day structure of Kamchatka. On Kamchatka there are three main zones of concentration of Quaternary volcanism: Middle Range, Central Kamchatkan Depression, Eastern Volcanic Zone. All are associated with regions of downwarping which stand out against a background of rising of the peninsula as a whole. The volcanic Quaternary zones are associated with regions of downwarping with a predominant synchronous regime of transverse dilatation. The dilatation zone ensures a general rising of magma from the deep horizons (crust-mantle transition layer) where the main magma hearths are situated and the volcanotectonics reflects the life of peripheral magma hearths situated in the higher crustal horizons. The rejuvenation of the faults forming the zone and the caldera depressions from south to north is evidence of propagation of the zone in this direction. There is a geodynamic disharmony between mantle and crustal structural stages (compression regime in the lower layers and dilatation in the higher horizons). The position of deep and peripheral magma hearths within a single volcanic zone may be related to the structural-dynamic stratification of the lithosphere. The structural-dynamic conditions beheath the volcanic zone are considerably more complex than would be surmised from simple subduction of an oceanic plate beneath an island arc. Figures 3; references: 20 Russian.
[444-5303/5915]

PHYSICS OF UPPER ATMOSPHERE

AEROSOL CHAMBER AT ATMOSPHERIC OPTICS INSTITUTE

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 10 Oct 85 p 4

[Text] The Institute of Atmospheric Optics belongs to a scientific-technical complex that has been created in Tomsk. This complex is the first of its kind in the USSR Academy of Sciences' Siberian Branch.

Comprehensive study of the propagation in the atmosphere of electromagnetic waves in the optical-frequency band is a main direction of research at the institute. The combining of basic research on a high level with introduction of its results on a broad scale in the economy is a characteristic feature of the work of the institute's staff. A major scientific school on problems of atmospheric optics has been formed at the institute. This school has earned recognition both in our country and abroad.

(A photograph showed two associates of the institute conducting experiments with the dispersing of clouds, fog and smoke in a small aerosol chamber.)

FTD/SNAP
/5915
CSO: 1865/41

JPRS-UES-86-001
10 January 1986

UDC 551.501.8:551.521.3

REGULARITY OF STRUCTURE OF INHOMOGENEITIES OF SCATTERING OF OPTICAL RADIATION AND THEIR RELATIONSHIP TO METEOROLOGICAL PARAMETERS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian
Vol 21, No 7, Jul 85 (manuscript received 12 Oct 81, after revision 4 Jun 84)
pp 720-725

POLKANOV, Yu. A., Belorussian State University; Applied Physical Problems Scientific Research Institute

[Abstract] Stable atmospheric stratification favors the suppression of turbulence in a flow, but it is maintained in a zone of collapse of internal waves, where a quite stable and regular turbulent structure is formed. In such zones relatively coarse-dispersed aerosol is retained, usually settling under the influence of gravity. Radiation scattered on such aerosol carries information on the spatial-temporal characteristics of turbulent structures. The most favorable conditions for study of such structures exist in the surface layer in a city at nighttime in summer. The study is based on the results of laser sounding of the atmosphere over Minsk, carried out in April, June 1978. Measurements were made successively in five different regions of the city. Sounding was in the horizontal plane at heights $\sim$20 m. Measurements along one path lasted 20 sec. The elapsed time between measurements on adjacent paths was $\sim$7-10 minutes. The radiation source operated at λ = 0.53 μm, radiated power was W = 0.01 J, pulse duration was 15 ns, radiation divergence was 20', pulse repetition rate was 50 Hz. The regularity of structure of a scattered signal amplified proportionally to the square of current time squared is analyzed. The regularity of structure was evaluated using the number of local maxima and minima of the signal. At nighttime a quite stable and regular structure of optical inhomogeneities in the horizontal plane was established. Its registry in lidar measurements was caused by the presence of urban polluting aerosol. There was a high degree of correlation between the parameters of the detected structure and stability of the thermodynamic state of the atmospheric surface layer test which was introduced, determined from meteorological parameters and their vertical distribution. The study revealed a significant correlation between a set of parameters describing these atmospheric formations and a set of meteorological parameters characterizing atmospheric humidity and inversion situations. The investigation shows that laser sounding can be used in predicting stability of stratification in the atmospheric surface layer. Figures 1, tables 1; references 15: 12 Russian, 3 Western.
[456-5303/5915]

UDC 551.596.1

SOUND RADIATION IN ATMOSPHERE DURING UNDERWATER EARTHQUAKE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian
Vol 21, No 7, Jul 85 (manuscript received 25 Aug 83, after revision 20 Jan 84)
pp 714-719

VDOVICHENKO, S. P. and ZASLAVSKIY, Yu. M., Gorkiy Scientific Research Radio Physics Institute

[Abstract] A number of seismic and hydrophysical precursors are now used in predicting tsunami waves, but this might also be done using acoustic fields in the atmosphere generated by hydroacoustic disturbances which are caused by seismic movements of bottom rocks during an underwater earthquake. The acoustic radiation entering the atmosphere from oceanic depths, accompanying a tsunamigenic earthquake, during propagation through parts of the toposphere and stratosphere, is characterized by an increase in the amplitude of oscillations of particles in the wave. A considerable amplitude of oscillations can be expected at altitudes with an appreciable content of ionized particles where a reflecting boundary is formed for signals of Doppler radars by means of which these oscillations can be detected. The author outlines different models of deepened seismic sources equivalent to an earthquake focus with respect to the total quantity of released energy. Although other authors have examined the problem of escape of sound oscillations into a rarefied atmosphere from the earth's surface in an ordinary earthquake, this article examines the characteristics of radiation introduced by the ocean water layer. The dependence of the level and directional diagram of radiation of focal depth is examined. The atmospheric model is exponential. The level of acoustic oscillations is examined at the maximum of the diagram at altitudes where the appearance of ionized regions detectable during sounding by Doppler radars is possible. Figures 4; references 8: 7 Russian, 1 Western.
[456-5303/5915]

UDC 534.222.1:551.596.1

CALCULATION OF SOUND FIELDS IN ATMOSPHERIC REFRACTION WAVEGUIDE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian
Vol 21, No 7, Jul 85 (manuscript received 5 Jul 83, after revision 22 Oct 84)
pp 707-713

RAZIN, A. V., Gorkiy Scientific Research Radio Physics Institute

[Abstract] In an earlier article (IZV. AN SSSR: FAO, Vol 18, No 6, pp 674-676, 1982) the author used the geometrical acoustics approximation in a study of sound propagation in a nonuniform moving atmosphere, giving numerical estimates of the influence of nonuniformity of air temperature and wind on the field of a fixed point isotropic source when the rays do not have a reversal point. Proceeding on the basis of that study, the author investigated waveguide sound propagation in the atmospheric surface layer when a ray, emanating

from a surface source at an angle to the horizon, may return to the surface as a result of refraction. It was assumed that the earth's surface is flat, the speed of sound and wind are dependent only on the vertical coordinate and wind speed has only horizontal components, that wind speed is much less than the speed of sound, and that in computing sound it is only necessary to take into account the geometrical divergence of rays and for frequencies below 1 KHz it is possible to neglect the small attenuation of acoustic waves during their propagation for several kilometers in the surface layer. Three cases of temperature stratification are examined for clarifying the influence of temperature nonuniformity on operation of an acoustic sounder in the moving surface layer: air temperature increases with altitude, air temperature decreases with altitude, isothermic atmosphere. Formulas are derived making it possible to determine the parameters and number of rays arriving at a point with stipulated coordinates. Numerical results are given on the influence of temperature gradients and wind on the intensity of sound generated by an acoustic sounder in the atmospheric surface layer. Figures 4; references 10: 7 Russian, 3 Western.
[456-5303/5915]

UDC 534.222:536.421

ACOUSTIC WAVE PROPAGATION IN POLYMERIC FLUID WITH VAPOR-GAS BUBBLES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 31, No 3, May-Jun 85
(manuscript received 9 Nov 83) pp 353-357

LEVITSKIY, S. P. and SHULMAN, Z. P., Voronezh State University imeni Leninskiy Komsomol; Heat and Mass Exchange Institute imeni A. V. Lykov, Belorussian Academy of Sciences

[Abstract] The authors studied the acoustic properties of polymeric fluids with bubbles. The multiple scattering method was used in investigating sound propagation in a relaxing fluid with vapor-gas inclusions. The approach used made it possible, in a broad temperature range, to make successive allowance for all the principal factors determining the process: compressibility and heat conductivity of the fluid during interaction of inclusions with the carrier phase and with one another, polydisperse character of the mixture, presence of vapor in the bubbles and distribution of fluid relaxation time. The point of departure is expressions, written in dimensionless form, determining the propagation of a monochromatic wave of weak nonisothermic disturbances in a relaxing polymeric medium with rheological equations of the hereditary type. The characteristic parameters used in the study were equilibrium radius of one of the bubbles, fluid density, pressure and temperature. A dispersion equation for a two-phase hereditary medium is derived and analyzed. Application of the equation is illustrated in a specific example. Figures 2, tables 1; references: 9 Russian.
[398-5303/5915]

UDC 551.590.21

INTERNAL GRAVITY WAVES, FLUCTUATIONS OF SOLAR ULTRAVIOLET RADIATION AND IONOSPHERIC PARAMETERS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 283, No 2, Jul 85
(manuscript received 26 Oct 84) pp 353-357

STEBLOVA, R. S., FREYZON, I. A., KOLTSOV, V. V., CHERTOK, Ye. I. GOROKHOV, Yu. V. VAZHERKIN, V. A., PANOVA, I. N. and KOGAN, M. G., Terrestrial Magnetism, Ionosphere and Radio Wave Propagation Institute, USSR Academy of Sciences, Troitsk, Moscow Oblast

[Abstract] It has been postulated that electron concentration disturbances in the range of periods from several to tens of minutes are a result of internal gravity waves; the IGW are related to lower atmosphere instabilities. This hypothesis has been checked in an experiment with simultaneous observation of f_0F2 changes and changes in the intensity of UV radiation at two widely spaced points: at Moscow and at a station along the Baykal-Amur Railroad (37°19'E and 124°27'E respectively). The observations were made on 31 July 1981 on the day of a total eclipse. The experimental data indicate a similarity and synchronism in variations of the ionospheric electron concentration maximum (f_0F2) and intensity of the near-UV registered at widely spaced surface points. However, this phenomenon cannot be fully explained within the framework of IGW theory. As a working hypothesis it can be proposed that solar radiation fluctuations can cause ionospheric wave disturbances. Published solar data make it possible to regard solar radiation variations in a wide range of the short-wave part of the spectrum as a source of fluctuations in ionsopheric plasma synchronous with fluctions in the intensity of UV radiation in the range 3000-3400 A. The reasons for and mechanism of appearance of such a synchronism remain unclear. Figures 2; references 15: 11 Russian, 4 Western.
[440-5303/5915]

UDC 551.508.769

DIALOG SYSTEM FOR NUMERICAL MODELING OF ENERGY LOSSES OF ATMOSPHERIC OPTICAL WAVES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 283, No 2, Jul 85
(manuscript received 26 Nov 84) pp 345-348

ZUYEV, V. Ye., academician, MAKUSHKIN, Yu. S., MITSEL, A. A., NESMELOVA, L. I., RODIMOVA, O. B., RUDENKO, V. P., TVOROGOV, S. D., FIRSOV, K. M. and YAKOVLEV, N. Ye., Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences, Tomsk

[Abstract] The article describes a dialog system ensuring automated numerical modeling of absorption of the energy of optical waves by atmospheric gas components for any spectral resolution. The system consists of a set of programs which in a dialog regime with a BESM-6 computer makes it possible to carry out computations of the characteristics of absorption by atmospheric gases

and the attenuation caused by atmospheric aerosols and molecular scattering and therefore computations of total atmospheric attenuation. The results can be displayed on a terminal screen, sent for printout or for incorporation in a data bank. The development of this dialog regime required the following: preparation of a working data bank; writing of algorithms for retrieval and sampling of absorption lines informative for stipulated conditions; writing of algorithms for speedy calculation of absorption characteristics. The working data bank includes the parameters of absorption lines of atmospheric gases (centers, intensities, half-widths, energies of lower states of molecular transitions); meteorological models (vertical distribution of pressure, temperature and concentrations of absorbing gases); continuum absorption constants; aerosol models. (Each of these is described, accompanied by a block diagram.) The system provides for three operating regimes (computation of the characteristics of absorption, scattering and total attenuation, inspection of initial data archives and inspection of absorption data archives). The system has a number of advantages in comparison with known sets of programs for solving such problems. The physicist working with the system, for example, requires no special training in the field of programming. Figures 1; references 10: 6 Russian, 4 Western.
[440-5303/5915]

UDC 535.2+535.317.1

ONE METHOD FOR COMPENSATING DISTORTIONS CAUSED BY ATMOSPHERIC TURBULENCE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 58, No 3, Mar 85
(manuscript received 23 May 83) pp 634-639

FILINOV, V. N. and CHERNYY, G. P.

[Abstract] The resolution of an aberration-free optical system is dependent on diffraction phenomena in the aperture and atmospheric turbulence. Many methods have been proposed to compensate the distortions caused by turbulence, but all have shortcomings. These require a spatial closeness of the investigated object and a reference source or a time constancy of properties of the distorting medium. Accordingly, the authors have developed a holographic method which is free of these shortcomings. The basis for the method is the use for compensation of the distortions caused by turbulence of an equality of the mean value of the phase fluctuations caused by the atmosphere to zero. The fundamental difficulty in applying this method is the problem of determining distribution of the field phase at the input aperture of the system. This distribution can be obtained only from interference experiments due to the high frequency of the light wave. In developing the method, the authors examine the influence of the finite dimensions of the investigated object on the attainable angular resolution in the retrieved image. The extent of the isoplanatism zone is determined. The results of computer modeling of the method are given, as well as the results of experiments for evaluating the extent of the isoplanatism zone. The presented materials demonstrate the feasibility of compensating the phase distortions introduced by atmospheric turbulence by means of averaging of the field phase in the aperture plane of the optical system after determining the phase distribution from interference measurements. The method is applicable for objects whose dimensions do not exceed the dimensions of the isoplanatism zone. Figures 2; references 9: 7 Russian, 2 Western.
[379-5303/5915]

ARCTIC AND ANTARCTIC RESEARCH

RESEARCH SHIP 'KURCHATOV' BACK FROM GULF STREAM'S ARCTIC ZONE

Moscow SOVETSKAYA ROSSIYA in Russian 10 Oct 85 p 2

[Text] Kaliningrad--Results of the expedition that has returned to port on board the scientific ship "Akademik Kurchatov" will benefit climatologists, fishermen and workers in polar regions. Investigation of physical-chemical processes occurring in the area where the warm Gulf Stream current meets the waters of the Arctic Ocean was the main purpose of this cruise to Arctic latitudes, in which scientists of the USSR Academy of Sciences' Institute of Oceanology imeni Shirshov took part. Materials that were gathered will provide a basis for making long-term forecasts of the weather and of ice and fishing conditions in this region of the world's oceans.

FTD/SNAP
/5915
CSO: 1865/41

TESTING OF WIND POWER UNITS AT ANTARCTIC STATION

Moscow VODNYY TRANSPORT in Russian 15 Oct 85 p 4

[Article by G. Sergeyev, Candidate of Geographic Sciences, head of Novolazarevskaya Station

[Text] Radio report--The testing of modern, multipurpose wind-driven power generating units is now in its third year at Novolazarevskaya Station, where weather conditions are severe. These units were developed at the "Vetroen" (wind power) Research and Production Association in Moscow. Two experienced specialists of this association usually spend the winter with the team at Novolazarevskaya, tending several units of this type. Each one generates 4-6 kilowatts. These 'windmills' heat buildings by converting the energy of wind into electric power.

One of the units is located on an ice dome near the outlying airfield. It sometimes replaces a diesel generator and provides enough electric power for heat, light, cooking, and charging storage batteries. The use of wind motors on the Antarctic continent will make it possible to save diesel fuel and to support various operations.

Thirty-seven scientists and specialists of the 30th Soviet Antarctic Expedition (SAE), including six colleagues from the German Democratic Republic, have now begun the second half of their long tour of duty at Novolazarevskaya. The two months of the winter polar night are behind them. More and more signs of spring are appearing day by day in this unique natural region of the white continent.

We are continuing year-round aerometeorological, geophysical, glaciological, biological and other studies in line with an expanded program. Plans now call for seasonal work, the turning-over of our research facilities to participants of the next, 31st SAE, and the unloading of this expedition's ships at the barrier ice of Cape Ostryy. We will get together with our closest neighbors--associates of the Republic of India's first station in the Antarctic.

FTD/SWAP
/5915
CSO: 1865/41

'SP-26' ARCTIC STATION'S MOVEMENTS AND ACTIVITIES

Moscow VODNYY TRANSPORT in Russian 26 Sep 85 p 4

[Article by N. Blinov, Candidate of Geographical Sciences, head of the "SP-26" station]

[Excerpt] Radio report--Summer has been left behind in the Central Arctic Basin. There has been no significant change lately in the location of the drifting scientific station "Severnyy polyus-26" (SP-26). It has moved only 60 kilometers to the north and has reached the 83rd parallel.

We are preparing for the long polar night. We have begun preparing a runway for receiving transport airplanes of Aeroflot. The aviators will deliver participants of the next "Sever" high-latitude aerial expedition, as well as a large shipment of various cargo items which we will need until spring of next year.

The scientists and specialists of the Arctic and Antarctic Institute who make up the personnel of "SP-26" are continuing the complex of aerometeorological, hydrologic, geophysical, actinometric and other studies.

FTD/SNAP
/5915
CSO: 1865/41

JPRS-UES-86-001
10 January 1986

UDC 551.464.6.02

POLLUTION OF ARCTIC SEAS BY RADIOACTIVE WASTES OF WEST EUROPEAN ATOMIC INDUSTRY PLANTS

Moscow ATOMNAYA ENERGIYA in Russian Vol 58, No 6, Jun 85
(manuscript received 17 Oct 83, after revision 8 Oct 84) pp 445-449

VAKULOVSKIY, S. M., NIKITIN, A. I. and CHUMICHEV, V. B.

[Abstract] The waters of the Barents, Kara and Greenland Seas were studied on the 12th cruise of the scientific research icebreaker "Otto Shmidt" in August-October 1982 for the purpose of determining the parameters of transport and determination of the limits of propagation of radioactive pollutants caused by atomic industry enterprises. A map of the occupied stations accompanies the text. The study revealed that radiation conditions in the western Arctic seas are influenced by the receipt of waters of the Norwegian coastal current, which is polluted by radioactive wastes. Anomalously high ^{137}Cs concentrations were registered in the southern part of the Barents Sea and Kara Sea and in the eastern part of the Greenland Sea. In the Greenland Sea the influence of transport of polluted water masses on radiation conditions is not as clearly expressed as in the Barents and Kara Seas, but is still significant. The deep profiles of ^{137}Cs and ^{90}Sr in different parts of the ocean are different depending on the relationship of arctic, Atlantic and river waters. (Two typical profiles are examined in detail.) The presence of a radioactive indicator (such as ^{134}Cs) in a measurable quantity can be used in solving problems related to the dynamics of waters and identification of water masses in the Arctic Basin. The method is based on temporal change in the ratio of $^{137}Cs/^{134}Cs$ concentrations as a result of the great difference in the half-lives of these radionuclides (30.1 and 2.1 years respectively). The tabulated data for the Greenland, Barents and Kara Seas suggest that the radioactive pollution observed there is also propagated to other parts of the Arctic Ocean. Figures 3, tables 1; references 10: 5 Russian. 5 Western.
[429-5303/5915]

UDC 552.6(99)

POSTULATED METEORITIC STRUCTURES IN ROSS SEA (ANTARCTICA)

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 8, Aug 85 (manuscript received 15 Aug 83) pp 128-132

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[Abstract] Much morphological and mineralogical information indicates that there are two structures on the Ross Sea shelf for which a meteoritic origin is possible (maps and diagrams accompany the text): the Ross structure (77.5°S, 178.5°E) and the Bauers meteor structure (71.2°S, 196°E), situated on the continental slope in the western part of Ross Sea between the Bauers and Scott canyons. The crater has a diameter of about 100 km and the wall rises as much as 800 m above the bottom. The Bauers annular structure corresponds to a concentric system of gravity anomalies with positive Δg values for horsts and netative values for grabens, as is typical for meteoritic structures. The clear expression of the crater in the relief, the fact that it is superposed on the present-day continental slope and is filling with thick strata of recent sediments are indicative of its youth. A meteorite explosion logically explains a number of contradictory facts concerning the geological history of the Ross Sea, especially the 300-km northward jump of the boundary of iceberg drift and cold-loving fauna in the ocean and the simultaneous interglacial and lush development of fauna in the Ross Sea 5-3 million years ago. After formation of the crater the waters of the Ross Sea for some time became warmer and the surrounding ocean became colder due to the thawing of ice transported from the Ross Sea ice shelf. It is stressed that the described meteoritic structures are still hypothetical. Figures 4; references 11: 5 Russian, 6 Western. [455-5303/5915]

UDC 551.321:621.396.969

ERROR IN METHOD FOR FLIGHT TESTS OF RADAR INSTRUMENTS FOR MEASURING ICE THICKNESS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 55, No 6, Jun 85 (manuscript received 10 Sep 84) pp 1159-1162

BOGORODSKIY, V. V. and OGANESYAN, A. G., Arctic and Antarctic Scientific Research Institute, Leningrad

[Abstract] In earlier articles and monographs V. V. Bogorodskiy formulated the physicotechnical principles for radar probing of ice, laying the basis for a new branch of radio physics which can be called radio glaciology. Various radar instruments for measuring ice thickness (ITR) have been introduced, but it is essential to have reliable means for precise determination of their metrological parameters. The errors in measurement instruments are determined in field tests by a comparison of the results of measurements made with the tested and reference (standard) instruments. The absolute error of a single i-th measurement is determined by the formula $\Delta x_i = x_i - x_{i0}$ (1), where x_i, x_{i0} are the results of measurements by the tested and reference instruments of the

true value y_i. However, flight tests of ITR are greatly complicated by lack of airborne reference ITR. Accordingly, a reference series $y_i = d_{i0}$ is obtained by drilling the ice at individual points along the flight line and measurement of its thickness with a ruler. It is virtually impossible to match the d_i and d_{i0} series. Instead of computations using (1) it is necessary to compute $\Delta d_i = d_i - d_{j0}$, with $i \neq j$ (2). But this can introduce a serious uncontrolled error which can reduce to naught all the expenditures on flight tests. The only possible solution is to find a method making it possible to use asynchronous series (2) with $i \neq j$. Such a method is developed, using as a point of departure an ideal ITR which forms a series d_i fully coinciding with the reference series d_{i0}. This serves as a basis for a method which can be used aboard an aircraft or a hovering helicopter. Another possible method not requiring synchronous series is based on the strong correlation of closely spaced ice thickness readings. This "quasisynchronous" method makes it possible to obtain the ITR rms error without a sample d_{i0} series (making it unnecessary to drill ice along the flight line), although this applies only to the standard deviation. In order to find the systematic error it is still necessary to measure ice thickness along the line, but asynchronous measurements are adequate for this purpose. The quasisynchronous method is particularly effective when two or more identical ITR are carried aboard an aircraft and only one transmitter is used in shaping the sounding signal. This method is the most suitable for ITR flight tests. References: 6 Russian.
[402-5303/5915]

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